to a corresponding brush 80. A first set of circuit traces 120 (indicated by solid lines) is on a first layer 122, a second set of circuit traces 130 (indicated by long dashed lines) is on a second layer 124, and a third set of circuit traces 140 (indicated by short dashed lines) on a third layer 142 carries an electrical signal to/from connection points 150 on the printed circuit board 100 of the electrical slip ring apparatus 10 to/from a corresponding brush 80. The printed circuit boards are preferably formed of glass reinforced epoxy laminate (FR4) and are bonded together using an epoxy polyamide cement.

As depicted in FIG. 4A, printed circuit board 100 has a pie shaped configuration having a circumferentially extending portion 155 and two radially inwardly extending portions 160, 162. Connection points 150 are located on the circumferentially extending portion 155 and the brush blocks 80 are mounted to each of the radially inwardly extending portions 160, 162 and extend circumferentially outwardly beyond the printed circuit board 100. The leads 90 are soldered to connection points 150.

Each of the brushes 80 is electrically connected to a corresponding trace on one of layers 122, 132, 142. As depicted in FIG. 4B, brush 80 is connected to a trace in layer 142. The brush 80 has a leg portion 170 and a curved portion

FIG. 4A

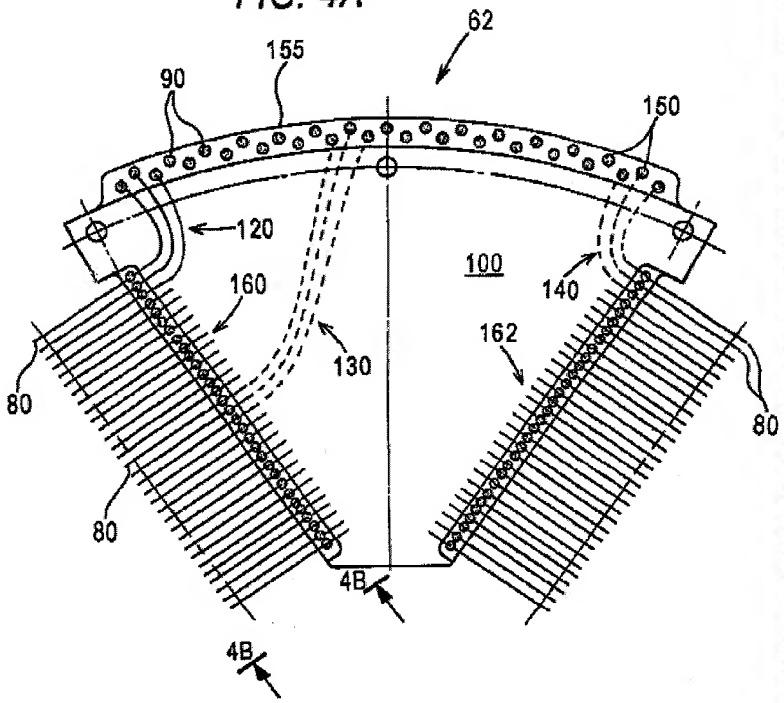
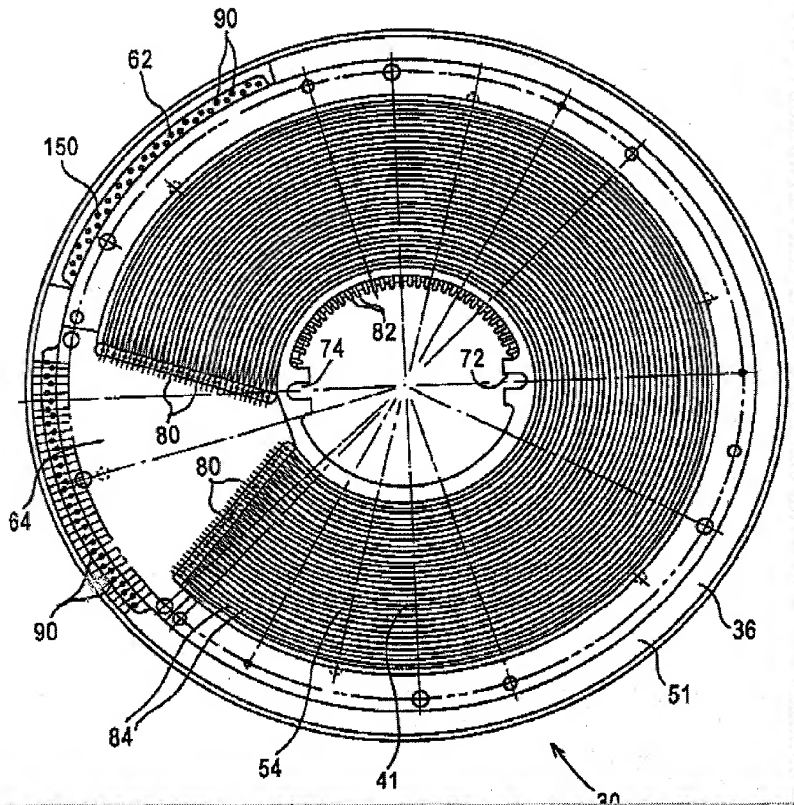


FIG. 4B

assembly 30 includes the electrical slip ring 41 which includes two preferably identical electrical slip ring halves 54, 56 bonded together and two preferably identical brush block assemblies 62, 64. The brush block assemblies 62, 64 are fixedly connected to the flanges 51, 52, respectively and extend radially inwardly therefrom. The electrical slip ring halves 54, 56 can be of different configurations. The brush block assemblies can also be of different configurations. The brush block assemblies 62, 64 are pie shaped with one edge fixedly connected to a corresponding flange 51, 52. Each brush block assembly 62, 64 is cantilevered from the flange 51, 52 and so rigidity of the printed circuit board of each brush block assembly 62, 64 is important in order to maintain uniform contact between the brushes and their respective electrical slip rings. The annular body 36 and brush block assemblies 62, 64 remain stationary relative to the housing 20 during the operation of the electrical slip ring apparatus 10 while the electrical slip ring assemblies 30, 32, 34 rotate. The brush block assemblies 62, 64 are located on opposite sides of the composite electrical slip ring 50 and are angularly spaced from each other in a circumferential direction. A plurality of leads 82 are electrically connected at an inner periphery of the electrical slip ring 41 to a rotary member (not shown). Each electrical slip ring half 54, 56 has a plurality of concentric

FIG. 2A

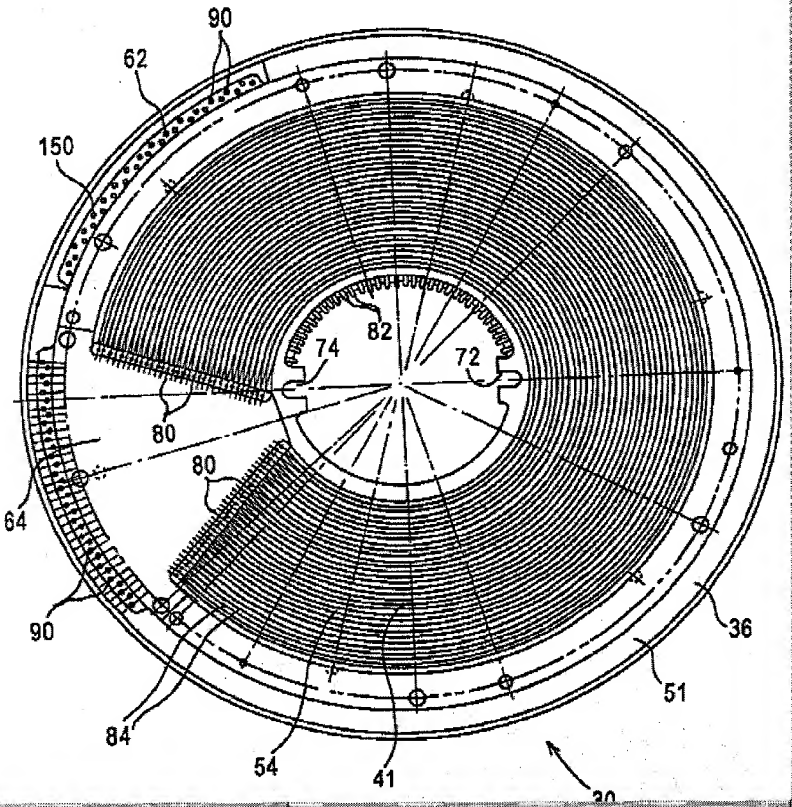


circumferential direction. A plurality of leads 82 are electrically connected at an inner periphery of the electrical slip ring 41 to a rotary member (not shown). Each electrical slip ring half 54, 56 has a plurality of concentric radially spaced electrical rings 84. Each brush block 62, 64 has a plurality of brushes 80 and is electrically connected to a corresponding plurality of leads 90. The leads 90 are soldered to corresponding connecting points 150. The electrical slip ring 50 has diametrically opposite radial slots 72, 74 for engaging the hub 48.

Refer now to FIG. 3A where a composite electrical slip ring 50 is depicted, according to the present invention, connected to the hub 48. As depicted in FIG. 3B, the composite electrical slip ring 50 includes the two electrical slip ring halves 54, 56 bonded together with epoxy polyamide adhesive to form the composite electrical slip ring 41. As depicted in FIG. 3B, the slip ring halves 54, 56 have a plurality of concentric spaced electrical rings 84. Each ring 84 has a groove 86 for receiving a corresponding brush 80. The groove is defined by a pair of side walls 89 and a radiused surface 91 connecting the sidewalls 89. Each of the electrical slip ring halves 54, 56 has a back surface 93, 94 to which electrical interconnecting circuits 95, 96 are located.

Refer now to FIGS. 4A and 4B which depict one of the brush block assemblies

FIG. 2A



	Type	L #	Hits	Search Text	DBs	Time Stamp
1	BRS	L1	550	(slip adj ring?) same (lead?)	USPAT; EPO; JPO; DERWENT	2001/11/24 15:48
2	BRS	L2	57296	(rotor? armature? field) same (winding? coil?)	USPAT; EPO; JPO; DERWENT	2001/11/24 15:35
3	BRS	L3	1155	(slip adj ring?) same (lead? wire?)	USPAT; EPO; JPO; DERWENT	2001/11/24 15:35
4	BRS	L4	42	3 same 2	USPAT; EPO; JPO; DERWENT	2001/11/24 15:36
5	BRS	L5	49	(slip adj ring?) same (inductor? inductan$2)	USPAT; EPO; JPO; DERWENT	2001/11/24 15:55
6	BRS	L6	17	2 and 5	USPAT; EPO; JPO; DERWENT	2001/11/24 15:48
7	BRS	L7	12	(slip adj ring?) same (inductor?)	USPAT; EPO; JPO; DERWENT	2001/11/24 16:07
8	BRS	L14	18	(slip adj ring?) same brush$2 same (inductor? inductan$2)	USPAT; EPO; JPO; DERWENT	2001/11/24 16:36